ON THE IDENTITY OF A PAIR OF STRONG LINES OF PECULIAR BEHAVIOR IN THE SPECTRA OF NOVA AQUILAE III

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In a paper[1] on "Movements of Four Unknown Lines in the Spectrum of *Nova Aquilae*," Mr. Paddock gives an account of two pairs of unidentified absorption lines which appear intermittently in the spectrum of *Nova Aquilae*, and which show conspicuous changes of position or wave-length. "In each pair the two lines have appeared and disappeared together, maintained equal intensities and practically constant distances apart, moved equal amounts at the same time, and in all respects have behaved like duplicates."

The present note relates to the more refrangible of these pairs, the greatest observed wave-lengths of which were, according to Mr. Paddock's measurements, λ4061, λ4068. In reference to these he states, "The distance between the lines ranged from 5 to 7 Angstroms. . . . . These variations are probably due to changing widths and appearances and it is very probable that the lines possess a constant difference of wave-length."

Plaskett in a paper,[2] "Notes on the Spectrum of *Nova Aquilae* No. 3," refers specially to the same pair of lines and their curious behavior.

An investigation of a set of spectra of *Nova Aquilae* kindly sent by Dr. Plaskett (being glass copies of the originals photographed by him at the Dominion Astrophysical Observatory, Victoria, B. C.) has led me to the view that the pair of anomalous stellar lines is probably identical with a pair of nitrogen lines at λλ4097.4, 4103.4, which show an abnormal behavior in laboratory spectra. An account of this abnormality was fully given in a paper[3] "On the Origin of Certain Lines in the Spectrum of ε *Orionis*," by Lockyer, Baxandall and Butler. There is no need to refer here to that paper in much detail, but it was shown that the stronger component at λ4097 of this pair of nitrogen lines occurred conspicuously in some of the spectra of the early B type (such as ε and κ *Orionis*) and in 29 *Canis Majoris*, where it is almost as strong as the adjacent Hδ line. The other member, λ4103.2 is so near the Hδ line that in

[1] *Pub. Ast. Soc. of the Pacific*, Vol. 31, page 54.
[2] *Journ. Ast. Soc. of Canada*, 1918, page 350.
[3] *Proc. Roy. Soc.*, Vol. 82, page 534.

stellar spectra of the type containing the nitrogen and hydrogen lines the former would usually be masked by the broad and strong Hδ line. Reference may here be made, however, to a paper by Professor Frost[4] in which it appears almost certain that he has recorded in the spectrum of 10 *Lacertae* both components of the pair under discussion, the Hδ line in his spectrum apparently being so narrow as not to coalesce with the adjacent nitrogen line. He has, however, suggested an identification of his λ4103 line with a "silicon (?) line." The silicon line at this wave-length is an arc or low temperature line, and its identification with the line in a stellar spectrum of the type discussed by Professor Frost is improbable. The presence of the comparison nitrogen line λ4097 in Frost's spectrum makes it far more probable that the stellar line λ4103 is ascribable to nitrogen.

Reference may here be made to the apparently abrupt change which Mr. Paddock records for July 1st, when the displacement of the strange pair is vastly greater than for any other day. From an examination of Plaskett's plates it seems almost certain that the pair of lines here accepted by Paddock as identical with that of the other days is another pair of lines altogether, and has no connection with the double discussed by him on other days. In fact, Plaskett's plate for July 1st shows another double in almost the same position as Paddock's usual double, altho it is not very pronounced.

The mean interval apart of the lines constituting Paddock's pair is 6.3 tenth meters. The interval between the two abnormal nitrogen lines is, according to Exner and Haschek's wave-lengths, 6.0 tenth meters. The stellar lines are always broad and diffuse and Paddock's wave-lengths given only to the nearest tenth meter.

The evidence on which the identity of the stellar and nitrogen lines is based may now be given.

In the study of the absorption lines in Plaskett's spectra it was found that from June 13th onwards the ordinary spark lines of nitrogen and oxygen, displaced some 30 to 40 tenth meters to the violet from their normal position, play a prominent part in the spectra. (The identity of lines at certain stages of the spectrum of *Nova Geminorum* II with lines of these gases was recently pointed out by Stratton.[5]) In the earlier spectra of *Nova Aquilae* III, up to June 13th, the enhanced lines of Fe, Ti, Cr, Mg, etc. (so conspicuously shown in α *Cygni*) had been a prominent feature. In suc-

[4] *Aph. Jour.*, **40**, 270, 1914.
[5] *Monthly Notices, R. A. S.*, **79**, 366, 1919.

ceeding spectra from June 13th onwards these lines gradually lose their strength, and altho on the 15th there are many of them still persisting, most of them are only of low intensity. At this stage the nitrogen and oxygen lines have developed considerably so that such well-known lines as 3995N $\left.\begin{matrix}4070\\4072\\4076\end{matrix}\right\}$O $\left.\begin{matrix}4317\\4319\end{matrix}\right\}$O and $\left.\begin{matrix}4415\\4417\end{matrix}\right\}$O and the whole of the strong air group from 4591 to 4676 can readily be recognized. Paddock's pair of lines at the measured positions near λλ4061, 4068 were found, whenever the presence of other nitrogen lines in the spectrum made comparison possible, to be ascribable to the two abnormal nitrogen lines at λλ4097, 4103, partaking of the same velocity displacement as many other well-authenticated nitrogen and oxygen lines in the spectrum of *Nova Aquilae*.

No light on the identity of Paddock's second double in the measured positions near λλ4560, 4576 has been obtained in the investigation of Plaskett's spectra.

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